

VEGETATED OR ROCK BIOSWALES**640.1 DESCRIPTION**

Work under this item includes the installation of vegetated and/or rock bioswales and associated appurtenances. Except as herein stated, the requirements specified for MAG Specifications 201, 215, 220, 425, 430, and 796 are applicable to this specification.

640.2 MATERIALS

See MAG Specifications 201, 215, 220, 425, 430, and 796.

640.3 CONSTRUCTION METHODS**640.3.1 Temporary Erosion Control**

Install all temporary erosion control measures prior to site disturbance. Install storm drain inlet protection to prevent clogging of the storm drains and increases in sediment loads to downstream stormwater facilities or waterbodies. Inspect erosion control measures at least once a week and after each rainfall event. **Maintain minimum distances between the bioswale and existing or planned structural members as recommended by the geotechnical report.** Make any required repairs immediately. Erosion control devices shall be maintained until the site is stabilized, as determined by the Engineer. If sediment is introduced into the swale during or immediately following excavation, the sediment will need to be removed from the vegetated bioswale or underdrain prior to initiating the next step in the construction process.

640.3.2 Swale Excavation, Backfilling, and Grading

Refer to MAG Specification Section 215 – Earthwork for Open Channels, except as follows: If the vegetated bioswale is used for runoff conveyance during construction, initial grading of the swale shall be performed in conjunction with rough grading of the site. Once construction in the contributing drainage area has been completed and the site is stabilized, re-grade and restore the bioswale to ensure functionality.

If an alternative temporary sediment basin facility is being provided before discharge to the bioswale, grading and construction of the vegetated bioswale should not be connected until the contributing drainage area has been completed and stabilized. If an underdrain is required per the construction documents excavate the underdrain to the specified depth (elevation) and follow ~~Specification 622 (nonexistent?)~~. Typical details would be required when connected to a downstream drainage facility. All subgrade material below the specified elevation shall be left undisturbed, unless otherwise directed by the Engineer.

Materials should be graded and contoured onsite when possible or excavated from the vegetated swale shall be disposed of on-site at locations (temporary stockpile areas) designated by the Engineer.

The perforated pipe (underdrain) shall be laid directly on the gravel bed. Grade and alignment shall not vary from the prescribed grade by more than 0.1 foot at any point. The joints between sections of pipe shall be connected in a fashion acceptable to Engineer. Once the pipe is in place, it shall be covered immediately with open-graded stone material as specified in the construction documents. The material shall be of uniform depth on either side of the pipe. Special inlets and special devices at the outlet end of the pipe shall be constructed as shown in the plans.

640.3.3 Check Dams

Refer to Specification 644 for check dam construction. Maximum spacing between check dams should be such that

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the toe of the upstream dam is at the same elevation as the top of the downstream dam. The maximum height of the dam should not exceed 2 feet.

640.3.4 Construction Sequence Scheduling

An implementation schedule should be included as part of the erosion control plan to identify the order of operations for construction activities. This is particularly important when constructing stormwater BMPs that are designed to infiltrate stormwater runoff. There are many construction activities which may contribute to the failure of a stormwater BMP if they are not planned for accordingly. The following items should be considered in developing an implementation schedule for a project:

- A. Perform continuous inspection of temporary construction access to ensure that it is providing adequate erosion and sedimentation control for the construction site.
- B. Install erosion protection along the perimeter of the site to prevent sediment from leaving the site during the construction process. Protection should be installed at a uniform elevation and constructed so that flow cannot bypass the ends.
- C. All down-gradient perimeter sediment-control BMPs (e.g. temporary outlet controls) must be in place before any up-gradient land-disturbing activity begins.
- D. Rough grade the site leaving the vegetated bioswale area undisturbed until the contributing drainage area has been completed and the site is stabilized.
- E. Construct the road/site improvements in a manner that minimizes adverse impacts to the location and function of the stormwater BMPs. For example, ensure that construction access or equipment staging areas do not conflict with the final location of the vegetated swale.
- F. Perform all other site improvements in a manner that minimizes adverse impacts to the location and function of the stormwater BMPs.
- G. Install any required erosion control blanket, ditch checks, and other semi-permanent and permanent erosion control measures.
- H. Stabilize the site by implementing the landscaping plan.
- I. Remove the temporary erosion and sediment controls after the swale is stabilized per the Engineer's approval. It is important for the bioswale to be stabilized before receiving stormwater flow.

640.4 MEASUREMENT AND PAYMENT

The unit of measure for vegetated or rock bioswales will be linear feet. The payment will be in accordance with the following MAG Specification Sections, including all labor, materials, tools, equipment and incidentals needed to complete work specified. Section 201 – Clearing and Grubbing Section 215 – Earthwork for Open Channels Section 220 – Riprap Construction Section 430 – Landscaping and Planting Section 796 – Geosynthetics

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CHECK DAMS FOR LOW IMPACT DEVELOPMENT FACILITIES

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644.1 DESCRIPTION

Work under this item includes the installation of check dams to slow and hold water flow in LID facilities. Except as herein stated, the requirements specified for MAG Specifications 201, 211, 215, 220, and 301 are applicable to this specification.

644.2 MATERIALS

The stone shall meet the requirements set forth in the design plans or modified in the special provisions.

644.3 GENERAL

644.3.1 Construction Requirements:

Stone Check Dam:

Construct the check dam with washed angular rock with D50 of 3 inches minimum (or approved equal) with side slopes of 3 to 1. Modification to this layout need to be approved by the Design Engineer. Place the stone so that it completely covers the width of the area and sides per the detail on the drawings. Form the overflow notch so that top of the outlet crest is approximately 4 inches lower than the outer edges.

Maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. The maximum height of the dam should not exceed 2 feet. Mechanical placement required to achieve complete coverage of swale and to ensure that center of dam is lower than edges.

644.4 MEASURE AND PAYMENT

The unit of measure and payment for stone check dam will be made per cubic yard and include installation, setting, and leveling of stone and all labor, materials, tools, equipment and incidentals needed to complete the work specified.

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LANDSCAPING AND PLANTING**430.1 DESCRIPTION:**

This section shall govern the preparation and planting of landscape areas required in the Plans or Specifications. Materials will be in accordance with Section 795.

Existing utilities and improvements not designated for removal shall be protected in place. Any damages will be repaired by the Contractor at no additional cost to the Contracting Agency.

Unless otherwise provided, walls, curbs, planter boxes, irrigation systems, and other improvements shall be constructed after rough grading has been completed and prior to finish grading.

430.2 GENERAL:

Landscape or planting areas shall not be cultivated when they are so wet as to cause excessive compaction or so dry as to cause excessive dust or the formation of large clods.

Prior to any grading the areas shall be cleared and grubbed in accordance with Section 201, Clearing and Grubbing.

Finish grade for these areas shall not vary more than 1 inch from the specified grade and cross-section and shall be a smooth uniform surface, free of any abrupt grade changes or depressions. Unless otherwise specified, finish grade below adjacent paving, curbs, or headers shall be 1 inch for lawn and granite areas and 3 inches for planting areas.

Unless otherwise specified, in-place soil will be prepared and conditioned for utilization as topsoil. If imported topsoil is specified or has to be used, the existing soil, before subgrade, shall be scarified to a depth of 6 inches prior to placing the topsoil and the thickness of the topsoil layer shall be at least 6 inches.

All landscape and planting areas, except those intended for lawns, shall be treated with a pre-emergence control, such as "Surflan" or equal, applied in accordance with the manufacturer's recommendations.

430.3 LAWN AREAS:

430.3.1 Preparation of In-Place Soil: After clearing and grubbing has been completed, the existing surface shall be scarified and cultivated to a minimum depth of 8 inches; then brought to finish grade. During the operation, debris, including all stones over 1 inch in any dimensions, shall be removed and disposed of offsite.

After clearing, grubbing, and initial cultivation has been completed, chemical fertilizer, 16-20-0 composition, shall be mechanically spread over the entire area at an average rate of 10 pounds per 1000 square feet. After spreading, the fertilizer shall be cultivated into the top six inches of soil using suitable equipment. The resulting soil shall be in a friable condition, suitable for planting.

The Engineer shall inspect and approve these areas prior to seeding.

430.3.2 Seeding: If a Bermuda summer lawn has not been established during its normal planting season, April through September, then rye grass (*Solium Multi-folium*) seed will be planted.

The rate of seeding shall be 3 1/2 pounds of Bermuda seed or 15 pounds of rye seed per 1000 square feet.

After seeding has been completed, the entire area shall be rolled with a lawn roller for leveling and seed retention.

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Immediately after rolling, the area shall be watered with a mist type spray until the soil is wet to a depth of 2 inches.

The Contractor shall provide the necessary safeguards to protect the planted areas from damage by erosion or trespass. Any damaged areas or any areas, greater than 6 inches in diameter, which fail to show a good stand shall be repaired and replanted until an acceptable stand of grass is obtained.

430.3.3 Maintenance: The Contractor shall be responsible for maintenance of the lawn areas until they are accepted by the Contracting Agency. This shall include watering, mowing, weeding and removal of all debris.

430.4 DECOMPOSED GRANITE AREA:

Decomposed granite shall be in accordance with Section 795. The Contractor shall confirm that a sufficient quantity is available so that the entire area will be of the same composition and appearance, and shall furnish a sample to the Engineer for approval as to color.

After preliminary grading is completed and the area has been cleared and grubbed, a pre-emergence control, such as Surflan, or equal, shall be applied over the entire area, in accordance with the manufacturer's recommendations. The decomposed granite shall be evenly distributed over the area with a minimum depth of 2 inches. Finish grading will be accomplished and the granite will be lightly watered and then compacted to an extent satisfactory to the Engineer. After compaction, a second treatment with the pre-emergence control will be accomplished.

430.5 TREE, SHRUB, AND GROUND COVER PLANTING:

The species, sizes, the manner in which to be furnished, and the approximate number are as shown in the plant list. The quantities, as listed, are approximate and the Contractor shall furnish and install all plant material necessary to complete the plantings as shown on the landscape plan. Change order adjustment will be made for unit price proposals, but not for lump sum proposals.

430.5.1 Substitutions: All requests for substitutions must be submitted in writing to the Contracting Agency prior to commencement of work on the project. The Contractor shall not take any further action concerning his request until a written approval or denial is received from the Contracting Agency. Plants of kinds other than those indicated on the plant list will be considered by the Contracting Agency only upon submission of proof that the specified plant is not reasonably procurable in the local region. Substitutions will resemble the specified plant in regards to appearance, ultimate height, shape, habit of growth, and general soil requirement.

Substitution of a larger size of the same species may be made by the Contractor without written approval. However, the Contracting Agency will not be responsible for any additional costs incurred by the Contractor, either for the additional cost of the plants or for any additional planting costs.

430.5.2 Plant Inspection Prior to Delivery to the Project Site: Prior to delivery of any species to the project site, the Contractor shall make the necessary arrangement with the Engineer for an inspection of the plant material at the offsite location. Any plants found to be unsuitable in growth or condition, or which are not true to name, shall be removed and replaced with acceptable plants.

430.5.3 Plant Protection after Delivery to the Project Site: Plants transported to the site shall be planted as soon as possible. During any interim storage period, they shall not be exposed to excessive sun or drying winds. Any stock, that in the opinion of the Engineer has deteriorated due to exposure or has been damaged during transporting, will be removed and replaced at the Contractor's expense.

430.5.4 Plant Location: The Contractor shall stake out the location of planting areas and plantings pit prior to any excavation. Subject to the Engineer's approval, minor relocations may be accomplished at this time to avoid generally unsuitable conditions, such as utilities, rocky areas, poor soil, etc. and to avoid natural growth inhibitions

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relating to species-specific requirements, including sunlight, space, inundation, etc. If major relocations are necessary, the Engineer will provide revised plans.

430.5.5 Ground Cover Areas: The planting beds shall be brought to finish grade before spreading the fertilizer or conditioning material specified. Fertilizing and conditioning material shall be mechanically spread at a uniform rate over the entire bed area. After spreading, this material shall be uniformly cultivated into the upper 6 inches of soil using suitable equipment. The resulting soil shall be in a friable condition suitable for planting. A pre-emergence control application is required prior to planting.

Ground cover shall be planted in moist soil with the spacing as indicated on the plans. Each plant shall be planted with its proportionate amount of soil so as to minimize root disturbance. After planting, the area shall be raked to restore a smooth finish grade and to provide drainage. Watering will begin immediately.

The Contractor is responsible for maintaining these areas until acceptance by the Contracting Agency. Maintenance will include protection from trespass or damage, weeding, watering, and removal of all debris. It may be necessary to install a protective fence or barrier around these areas until growth is assured.

430.5.6 Shrub and Tree Pits: Planting pits shall be approximately circular with a diameter and depth at least twice the size of the plant ball or container. It must be large enough to permit handling and planting without injury or breakage of the root ball or root system. Unless otherwise specified, the excavated soil will be conditioned and used as prepared soil mix for backfill. Plants will not be allowed to stand in these pits without watering.

Prepared soil mix shall consist of one part organic soil conditioner (Section 795), two parts excavated soil and one pound of gypsum and four ounces of soil sulphur per tree or one-half pound of gypsum and two ounces of soil sulphur per shrub. The backfill shall be produced by thoroughly combining these components into a homogeneous mixture. The Contractor shall notify the Engineer prior to mixing prepared soil so that he may observe the mixing process. In addition, during backfilling, slow release fertilizer tablets, Agriform 21 gram tablets with a 20-10-5 analysis, shall be added in the following quantities:

For one-gallon container	1 tablet
For five-gallon container.....	2 tablets
For fifteen-gallon container.....	4 tablets
For twenty-four inches or larger box.....	6 tablets

All containers shall be opened and removed in such a manner that the roots of the plant are not damaged. Balled plants wrapping shall be loosened or cut back after the plant is positioned in the pit.

A layer of prepared soil mix shall be placed in the pit and the plant shall be set approximately in the center of the hole with the root crown at its natural growing depth with respect to finish grade. The plant shall be faced so as to present the best appearance and relationship to adjacent plants or structures. It shall be rigidly constrained until backfilling with prepared soil mix and slow release fertilizer tablets is completed. The backfill will be thoroughly settled by tamping and watering so that all voids are filled.

Trees shall be supported by two tree stakes (Section 795) with a top tie placed for maximum support and a second tie placed midway between top tie and ground level.

After planting, the plants shall be pruned as directed by the Engineer.

430.6 HEADER INSTALLATION:

Headers shall be installed at the location and grades as shown on the plans prior to planting operations. Stakes shall be located at corners and at intervals not to exceed 5 feet and shall be driven to slightly below the top of the header.

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Headers shall be nailed to the stakes with two nails, clinched 1/2 inch. Splice plates shall be used at butt joint; centered on the joint and nailed with four nails.

430.7 CLEAN UP:

Any debris or other material dropped onto paved or graded area during excavation or hauling operation shall be promptly removed and these areas shall be kept neat and clean at all times. Upon completion of planting operation, all remaining soil, stones, and other debris shall be removed from the site and disposed of to the satisfaction of the Engineer.

430.8 PLANT GUARANTEE AND MAINTENANCE:

The Contractor shall insure that all plant materials are in a sound, healthy, vigorous condition free from insects, bark abrasions, or other objectionable disfigurements and shall immediately replace any plant which is unacceptable at any time up to and including final acceptance of the project or completion of the plant establishment period whichever occurs later. When the termination of the plant establishment period extends beyond the final acceptance date for the project, this additional period of time for plant establishment may be considered as a special warranty period within the standard 1-year guarantee period and the Engineer may authorize final payment in accordance with Section 109. Unless otherwise authorized by the Engineer, the Contractor shall maintain all landscaped areas on a continuous basis as they are completed during the course of work and until final project acceptance or the termination of the plant establishment period, whichever occurs later.

Maintenance shall include keeping the landscape areas free of debris, weeding, and cultivating the planted areas at intervals acceptable to the Engineer. The Contractor shall provide adequate personnel to accomplish the required maintenance. Pruning and restaking of plants shall be as directed by the Engineer.

430.9 PLANT ESTABLISHMENT PERIOD:

The Contractor shall request an inspection by the Engineer whenever substantial completion of the planting and related work has been accomplished. After this initial inspection, and subject to his approval of the work, the Engineer will issue a written field notification to the Contractor setting the effective, beginning date for plant establishment. The plant establishment period shall be for a period of 60 calendar days, but is subject to extension by the Engineer if the landscape areas are improperly maintained, appreciable plant replacement is required, or other corrective work becomes necessary.

At final project acceptance or at the end of the plant establishment period, a final acceptance inspection of the planted areas will be made by the Engineer.

430.10 MEASUREMENT AND PAYMENT:

Measurement and payment shall be in accordance with Section 109.

The lump sum or unit prices established on the proposal sheet shall be full compensation for furnishing all labor, material, tools, and equipment and for performing all work necessary to complete the landscaping operation to include planting of trees, shrubs, and ground cover.

- End of Section -